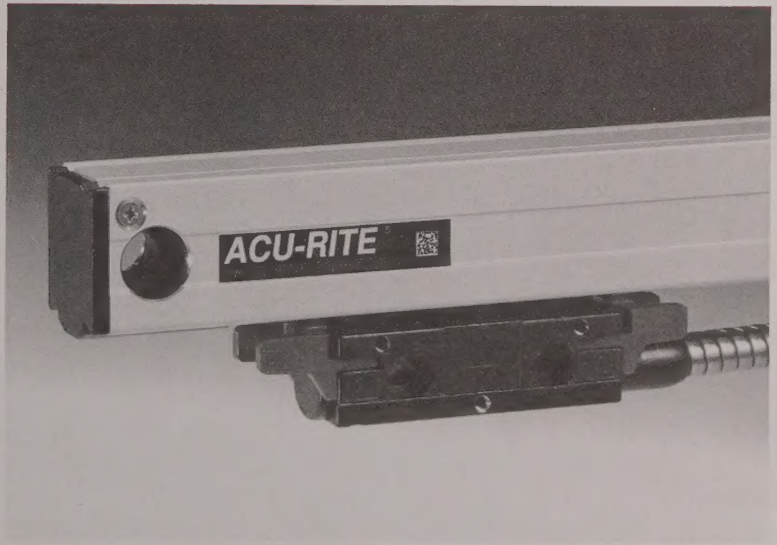
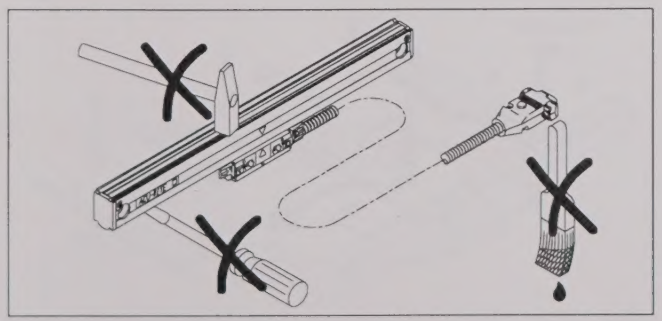
ENC 150™

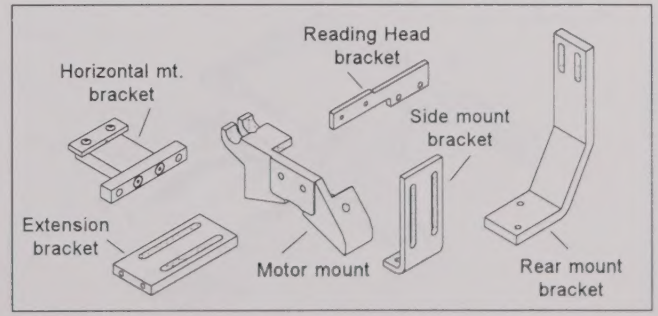


REFERENCE MANUAL

ACU-RITE®

	Page
Introduction	2
Mounting Preparation	3
Mounting Information	4
Encoder Dimensions	5
Backup Spar Dimensions	6
Mounting Requirements	7
Typical Mounting (s)	8
Encoder Installation Procedure	9
Spar Installation Procedure	11
Checking your Installation	13
Electrical Shielding	14
Troubleshooting	15
Mechanical Specifications	16
Output Signals and Pin-Outs	17
Electrical Specifications	18
The ACU-RITE Warranty	19





- Installation brackets and kits are available.
- Your Authorized ACU-RITE Distributor can assist you with your selection of these for your installation.

The ENC 150 precision glass scale linear encoder provides the accuracy and reliability of an ACU-RITE measuring system with digital output (analog output available). Features and options include:

- Resolutions of .5, 1, 2, 5, or 10 µm.
- Accuracy grades of ± 3, and ± 5 µm / 1000 mm.
- Vinyl or Armor cables of 2, 5, 10, 15 and 20 ft. length.
- Fasteners, center supports, and backup spars.
- Brackets and accessories.

Contact your Authorized ACU-RITE Distributor for assistance with the selection of product options and accessories.

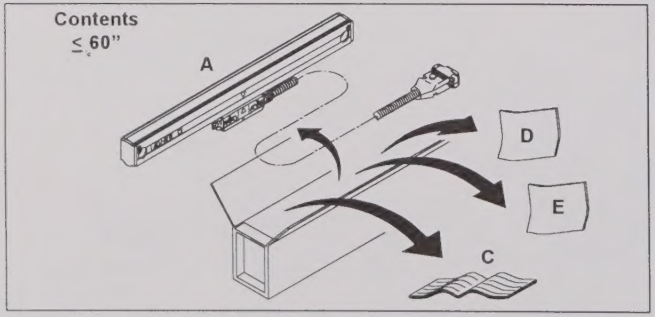
For future ordering information or warranty service, record the linear encoder catalog number located on the scale assembly tag, and the serial number from the reading head tag.

	Catalog No.	Serial No.
Axis # 1:		
Axis # 2:		
Axis # 3:		
Axis # 4:		
Date of purchase:		

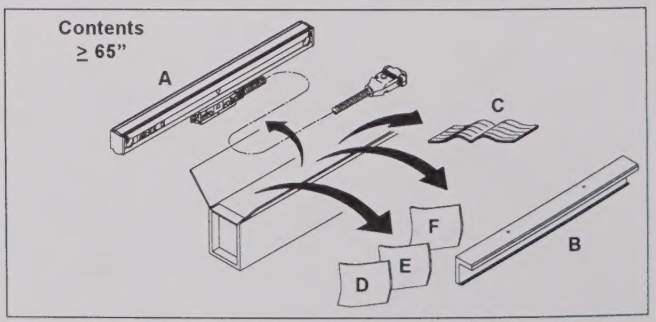
Distributor: _____

Address: _____

Telephone: _____



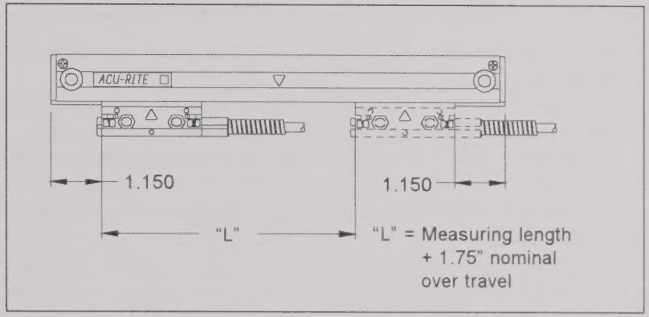
A) ENC 150 Linear Encoder
B) Backup Spar
C) Reference Manual



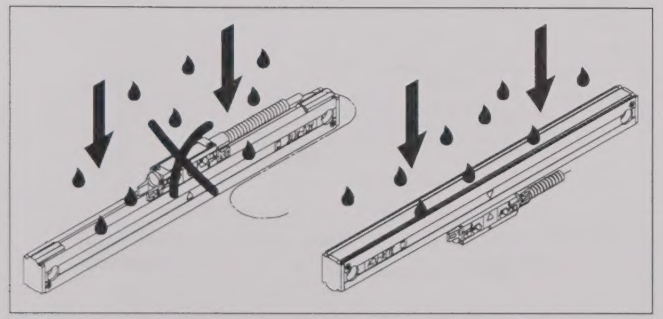
D) Cable Mounting Hardware
E) Linear Encoder Mounting Hardware
F) Backup Spar Mounting Hardware

Please follow these preparation guide lines.

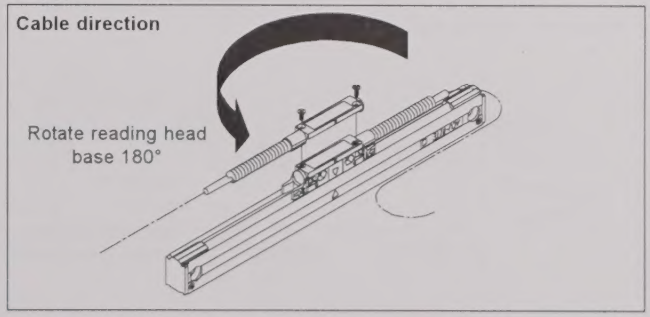
- Understand your mounting requirements.
- Mount with lip seals down and away from the work area.
- Brackets should be kept as short as possible and rigid.
- Surfaces must be in good condition, clean, and free of dirt. Remove paint from machined mounting surfaces.
- ⚠ **Alignment brackets must not be removed until instructed.**



- Machine travel can not exceed the encoder measuring length.
- Either limit machine travel or obtain correct length scale.



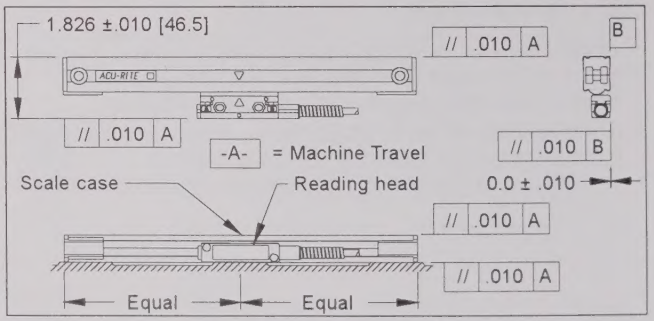
- Never mount with lip seals upward or towards work area.



- Determine cable exit direction before installing.
- To change cable exit direction; remove base and rotate 180°.

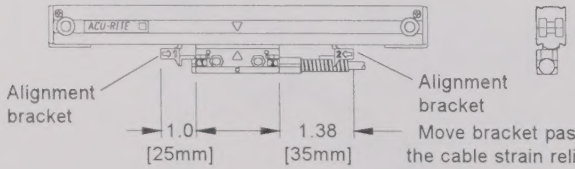
Use this information to plan your Linear Encoder installation.

- Mount the linear encoders close to machine guide ways to ensure system accuracy.
- One side of the linear encoder addresses flush mounting surfaces, and the opposite side addresses offset mounting surfaces.
- If space between the reading head and the mounting surface exceeds .18", use a spacer or mounting bracket to reduce space.
- ACU-RITE bracket kit instructions provide step by step installation proceedures.

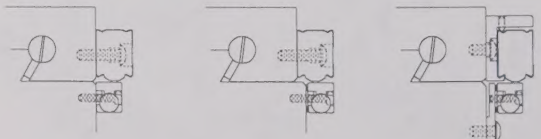


- Tolerances of .010" TIR apply to all mounting dimensions.
- Center support mounting surface required for 24" through 60" linear encoder measuring lengths mounted without a spar.

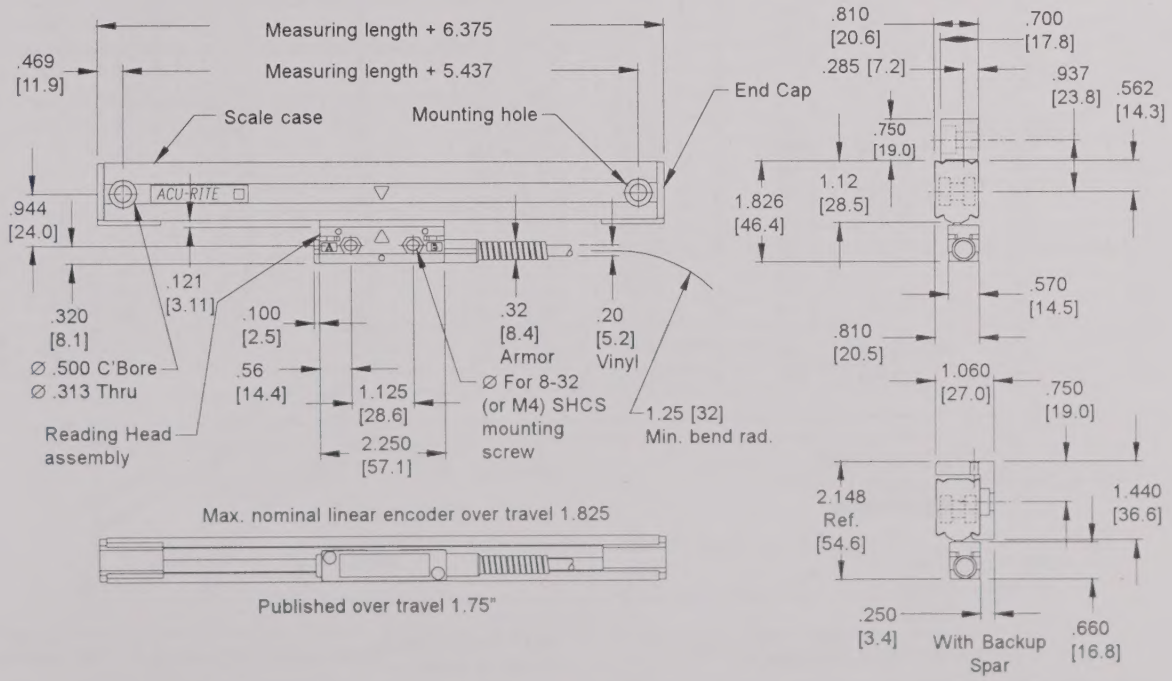
Alignment bracket removal clearance



- Allow clearance for alignment bracket removal.
- ⚠ **Alignment brackets must not be removed until instructed.**

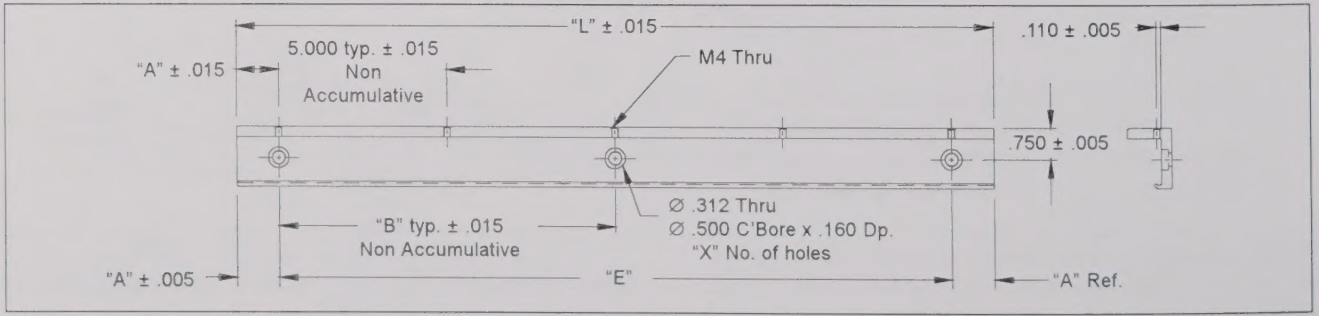


- Use reading head leveling set screws when surfaces are not flush.
- Reading head bracket required for a space >.18".


Measuring length + 6.375
Measuring length + 5.437
.469
[11.9]
Scale case
Mounting hole
End Cap
ACU-RITE
.944
[24.0]
.121
[3.11]
.320
[8.1]
Ø .500 C'Bore
Ø .313 Thru
Reading Head
assembly
.100
[2.5]
.56
[14.4]
1.125
[28.6]
2.250
[57.1]
.32
[8.4]
Armor
Ø For 8-32
(or M4) SHCS
mounting
screw
.20
[5.2]
Vinyl
1.25 [32]
Min. bend rad.
Max. nominal linear encoder over travel 1.825
Published over travel 1.75"
.810
[20.6]
.700
[17.8]
.285 [7.2]
.937
[23.8]
.562
[14.3]
.750
[19.0]
1.826
[46.4]
1.12
[28.5]
.570
[14.5]
.810
[20.5]
1.060
[27.0]
.750
[19.0]
2.148
Ref.
[54.6]
1.440
[36.6]
.250
[3.4]
With Backup
Spar
.660
[16.8]

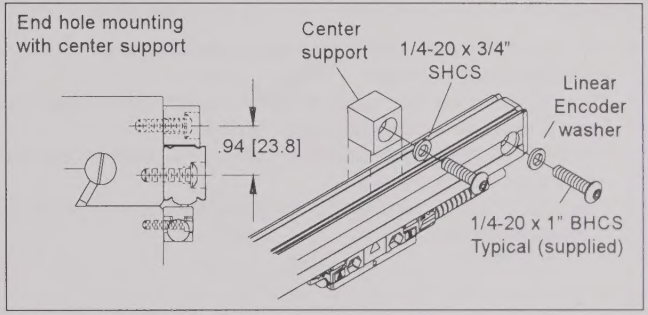
Backup spar Part Number	Linear Encoder Measuring Length	L	A	X No. Places	B
385102-000	2	8.312	1.656	2	5.000
385104-000	4	10.312	2.656	2	5.000
385106-000	6	12.312	1.156	2	10.000
385108-000	8	14.312	2.156	2	10.000
385110-000	10	16.312	3.156	2	10.000
385112-000	12	18.312	4.156	2	10.000
385113-000	13 (Special)	19.312	1.44	2	16.43
385114-000	14	20.312	5.156	2	10.000
385116-000	16	22.312	1.156	3	10.000
385118-000	18	24.312	2.156	3	10.000
385120-000	20	26.312	3.156	3	10.000
385122-000	22	28.312	4.156	3	10.000
385124-000	24	30.312	5.156	3	10.000
385126-000	26	32.312	1.156	4	10.000
385128-000	28	34.312	2.156	4	10.000
385130-000	30	36.312	3.156	4	10.000
385131-000	31.5	38.030	4.015	4	10.000
385132-000	32 ("E" 34.812)	35.687	.437	4	11.604

Backup spar Part Number	Linear Encoder Measuring Length	L	A	X No. Places	B
385135-000	35 ("E" 40.437)	41.312	.437	5	10.109
385136-000	36	42.312	1.156	5	10.000
385138-000	38	44.312	2.156	5	10.000
385140-000	40	46.312	3.156	5	10.000
385142-000	42	48.312	4.156	5	10.000
385148-000	48	54.312	2.156	6	10.000
385152-000	52	58.312	4.156	6	10.000
385154-000	54	60.312	5.156	6	10.000
385160-000	60	66.312	3.156	7	10.000
With Encoder	65	71.312	5.656	7	10.000
With Encoder	72	78.312	4.156	8	10.000
With Encoder	78	84.312	2.156	9	10.000
With Encoder	84	90.312	5.156	9	10.000
With Encoder	90	96.312	3.156	10	10.000
With Encoder	100	106.312	3.156	11	10.000
With Encoder	110	116.312	3.156	12	10.000
With Encoder	120	126.312	3.156	13	10.000

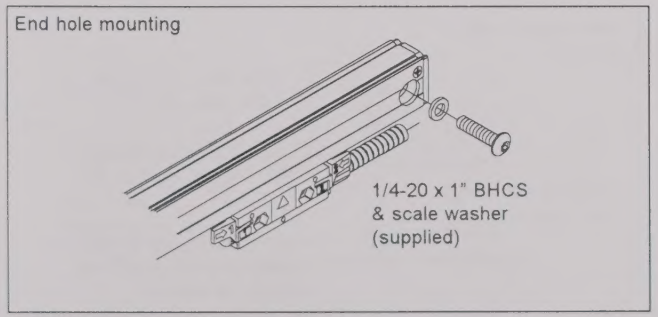


Mounting options can be adapted to machine mounting surfaces using spacers, standoffs, or leveling set screws.

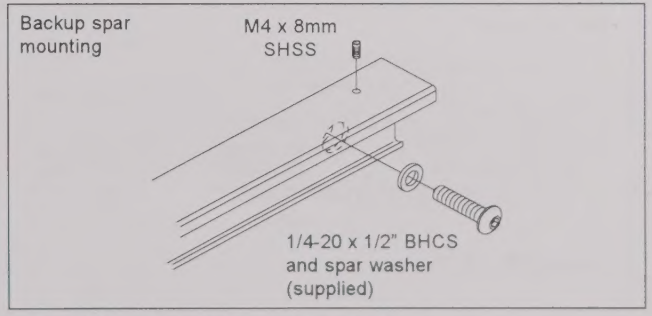
- Measuring length and mechanical configuration of your machine determine your options.
- Backup spar mounting is an option but not required for lengths up to 60".
- Fastener lengths described on this page are included with the encoder or the backup spar.



- 24" to 60" : Use end mounting holes with center support.



- Less than 24" : Use end mounting holes.

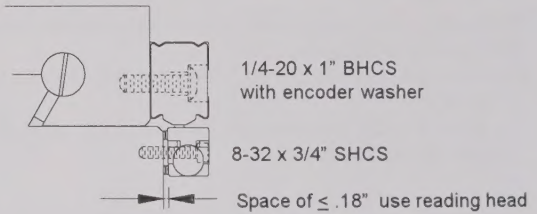


- Over 60" : A backup spar is required.

A variety of mounting conditions can be accommodated.

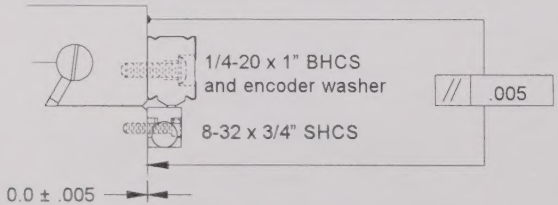
- The machine configuration determines the brackets required to install the linear encoder.
- Three typical mounting conditions are shown; flush, offset, and backup spar (as shown previously on page 4).
- The 8-32 SHCS fastener lenghts shown on this page are supplied with the encoder hardware.
- The 8-32 SHCS for mounting the reading head is a standard low head style fastener.

Offset surfaces



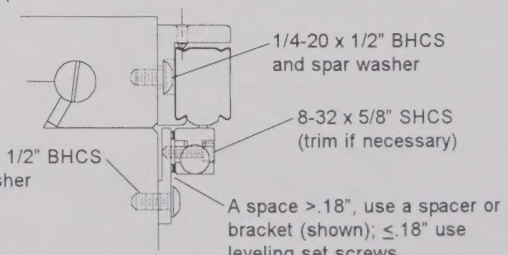
- Mounting surfaces are offset.
- Installation without backup spar.
- Use leveling screws in place of spacers or shims.

Flush surfaces



- Mounting surfaces are flush within .005".
- The reading head leveling screws are not required.

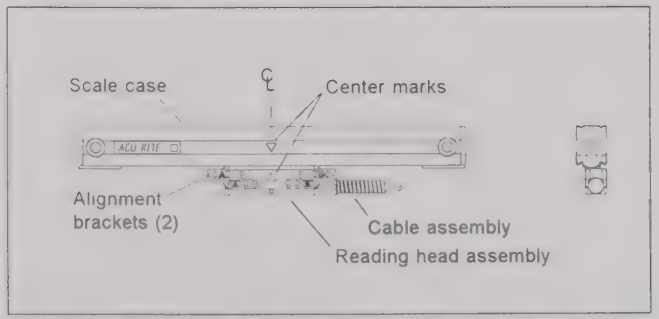
Backup spar with bracket



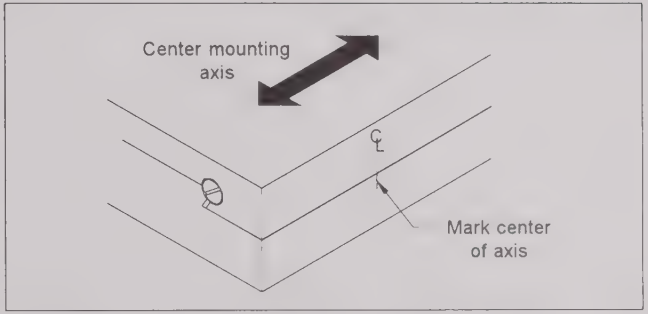
- Flush or offset mounting surfaces with a backup spar.
- Bracket used to reduce head to mounting surface gap.
- Use reading head leveling set screws.

These steps apply to all encoder mounting conditions, if a spar is being used, go to "Spar Installation Procedure" on page 11.

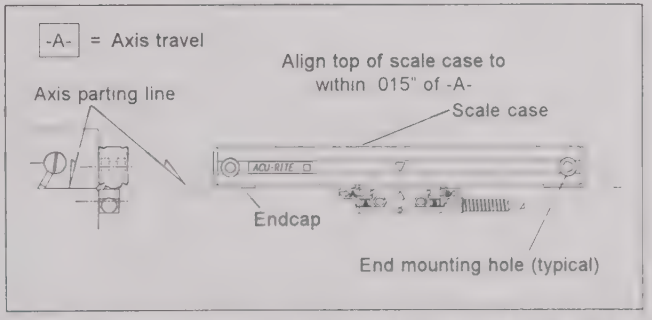
- ⚠ **ACU-RITE bracket kit instructions supercede this section.**
- Adjust drill depths and fastener lengths as required.
- **When instructed on page 10:** Adjust the leveling set screws as follows:
  1. Insert, but do not tighten 8-32 (M4) reading head screws.
  2. Place a .001"-.003" shim between the leveling set screws and mounting surface.
  3. Adjust each set screw until a slight drag is felt on the shim.
  4. **Evenly tighten the 8-32 (M4) reading head mounting screws.**
- Contact your Authorized ACU-RITE Distributor should you require additional assistance.



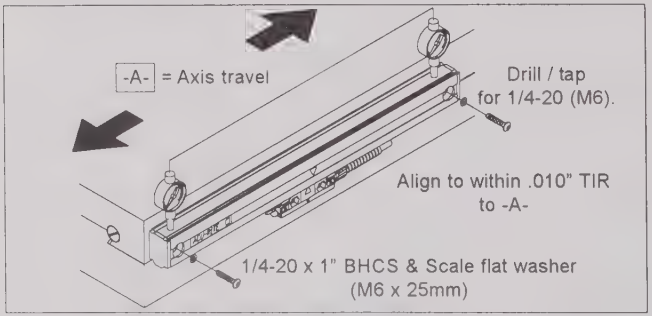
- Align the center marks on the reading head and scale assembly by sliding the reading head and brackets along the case



- Move the machine axis to its center of travel.
- Mark the axis for quick return to center
- Configure the encoder cable exit direction (see page 3).

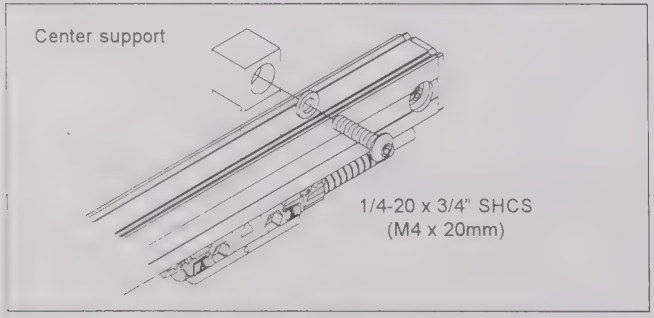


- Locate the scale case so underside of endcaps are flush with the axis parting line.
- Mark one end mounting hole location.

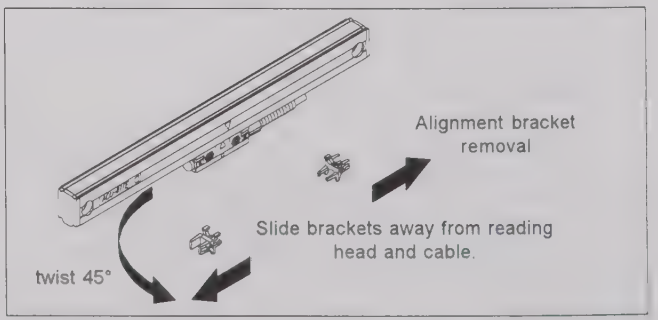


- Drill / tap the first end mounting hole / attach the linear encoder.
- Align to within .010" TIR. to -A-, drill / tap second end hole.
- Attach the linear encoder / align to within .010" TIR. to -A-.

- Center the axis and mark the reading head mounting holes.
- Move axis, drill / tap holes for 8-32 (M4).
- Attach head to axis / Set leveling screws / Secure fasteners.



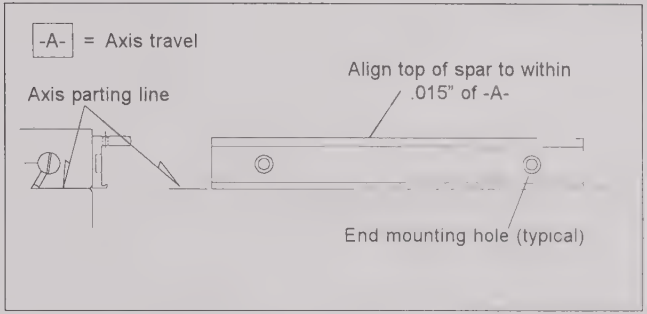
- Use the center support(s) when provided.
- Place supports at equal intervals along the encoder's length



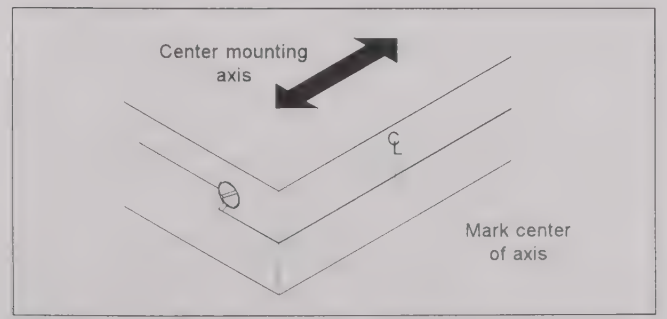
- Slide the brackets away from the reading head.
- Remove the alignment brackets and save for future use
- Proceed to page 13, "Checking Your Installation".

These steps apply to all spar mounting conditions.

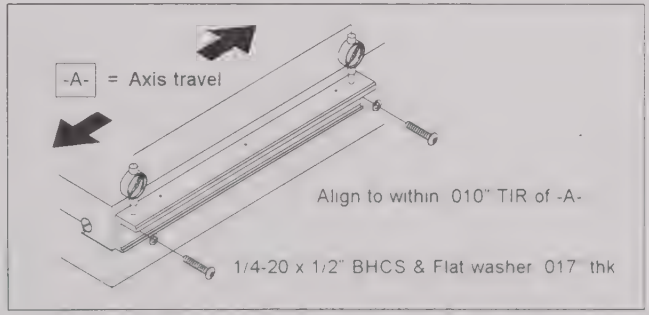
- ⚠ **ACU-RITE bracket kit instructions supercede this section.**
- Adjust drill depths and fastener lengths as required.
- **When instructed on page 12:** Adjust the leveling set screws as follows:
  1. Insert, but do not tighten 8-32 (M4) reading head screws.
  2. Place a .001"-.003" shim between the leveling set screws and mounting surface.
  3. Adjust each set screw until a slight drag is felt on the shim.
  4 **Evenly tighten the 8-32 (M4) reading head mounting screws.**
- Contact your Authorized ACU-RITE Distributor should you require additional assistance.



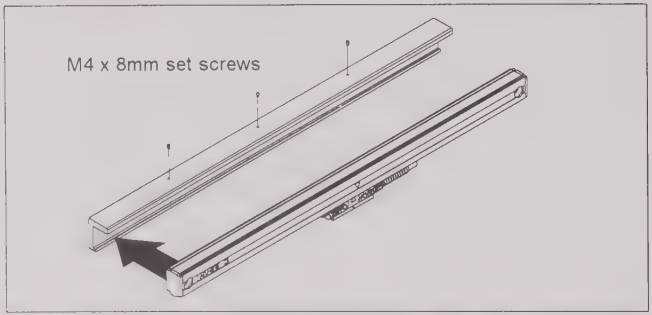
- Locate the spar with the underside flush with the axis parting line
- Mark one end mounting hole location.



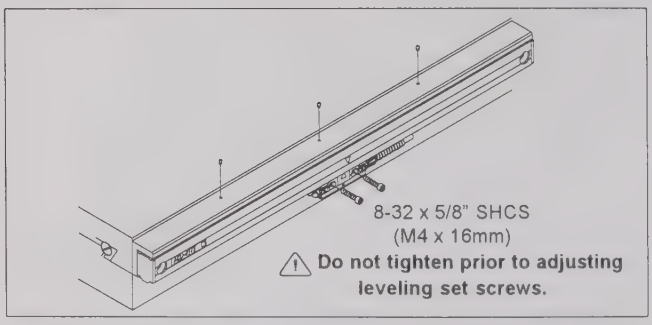
- Move the axis to its center of travel
- Mark the axis for quick return to center
- Determine encoder cable exit direction and adjust (see page 3)



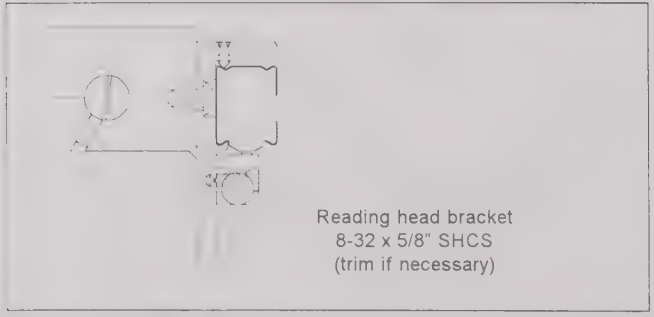
- Drill / tap the first end mounting hole / attach the spar
- Align to within .010" TIR to -A- drill / tap second end hole
- Attach the spar / align to within .010" TIR to -A-



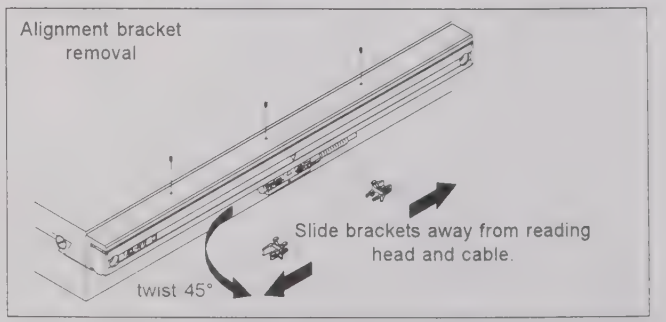
- Insert the encoder into the spar.
- Center the encoder from end to end with the spar.
- Lock in place by tightening the M4 set screws.



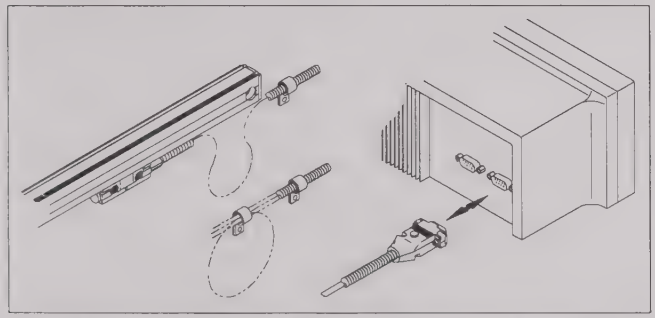
- Attach the bracket to the machine.
- Align the reading head mounting holes with the bracket holes
- Attach head to bracket / Set leveling screws / Secure fasteners



- To locate the reading head bracket, attach it to the reading head.
- Center the axis and mark the bracket mounting holes.
- Remove the bracket, drill / tap holes for 1/4-20 (M6).



- Slide the brackets away from the reading head.
- Remove the alignment brackets and save for future use



- Route the cables with slack loops to allow for axis motion.
- Secure excess cable by fastening with clips or ties.
- Attach the linear encoder connectors to the readout.

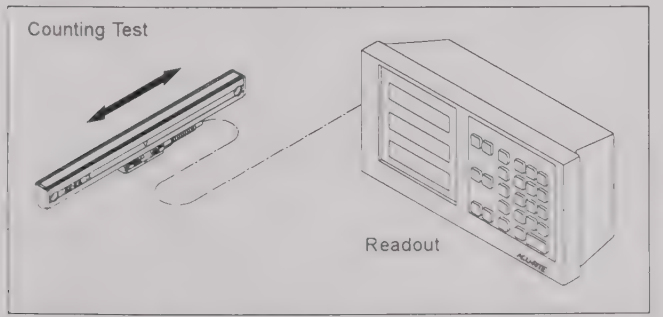
These steps will confirm proper operation of your installation The Counting Test confirms proper electrical operation. The Repeatability Test checks the installation integrity.

Counting Test:

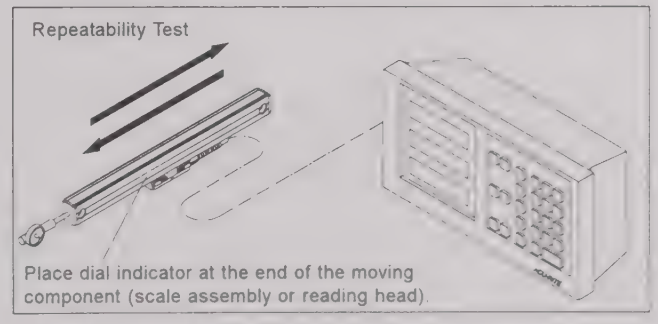
- Configure the readout's encoder and display resolution (see manual).
- Move the axis and compare the display to the movement.
- Configure readout for sensing reference marks.
- Move each axis a minimum of 20mm (axis display should zero)

Repeatability Test:

- Locate an indicator on one end of the encoder and zero the readout and indicator.
- Move the axis through the full travel and return to dial zero
- Readout should read zero ± 1 count.



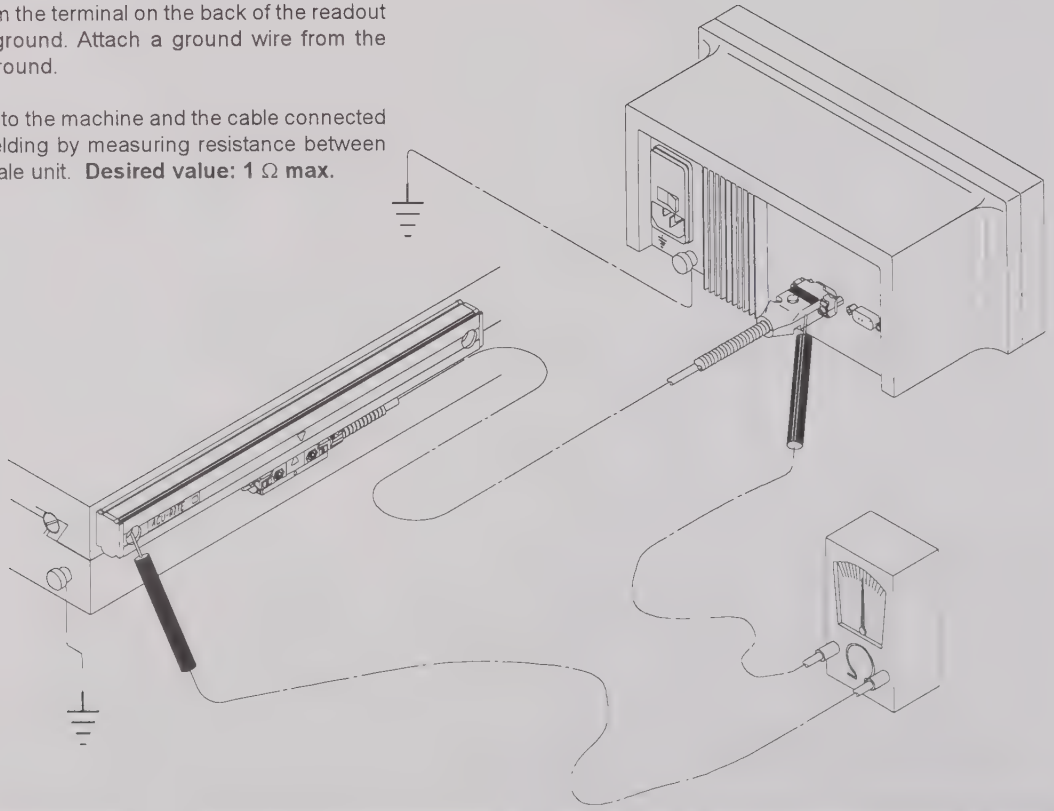
- Move the axis and compare the display to the movement
- Move the axis 20mm (79") to check reference mark operation



- Zero the display and indicator
- Move axis to the end of it's travel return to dial zero
- Readout should read zero ± 1 count.

Connect a ground wire from the terminal on the back of the readout to the machine or earth ground. Attach a ground wire from the machine to a solid earth ground.

With the encoder attached to the machine and the cable connected to the readout, check shielding by measuring resistance between connector housing and scale unit. **Desired value: 1 Ω max.**



If you experience difficulties with your installation, do the following to determine the problem.

Checking the Readout

Difficulties on more than one axis are usually associated with the readout. Follow these steps to determine if your difficulties are associated with the readout:

- Insure that the linear encoder connectors are correctly seated.
- Swap linear encoder cables at the readout to see if the problem is still shown in the same display.
- If the problem remains in the same display, the readout is in error.
- If the problem follows the connection change, the linear encoder may be in error.

If the Readout is at fault, refer to "**What to do**" to arrange for the parts necessary to repair your system. If a linear encoder appears to be at fault, proceed with "**Checking the Linear Encoders**".

Checking the Linear Encoders

Problems on a single axis are usually associated with the linear encoder or its installation. Difficulties can be caused by improper installation, loose or misaligned bracketry, or a damaged or inoperable encoder.

Follow these steps to determine the cause of your system difficulties:

- Confirm that your bracketry and installation does not interfere with other machine structures through the entire length of the linear encoder travel.
- Check for loose fasteners. If you find loose fasteners, first confirm that the linear encoder is installed to the tolerances specified and then retighten the fasteners as required.
- Confirm that the linear encoder is installed to the required tolerances by checking the alignment tolerances specified on Page 4. If the installation does not meet the tolerances, reinstall the encoder according to the "**Installation Procedure**"
- Perform a Repeatability Test as described on Page 11. If the linear encoder is installed to the required tolerances, the bracketry and encoder have been checked for interferences and loose fasteners, and the encoder fails the repeatability test, the encoder is likely at fault.

Do not attempt to repair the reading head or scale assembly. The ENC 150 is field serviceable by assembly replacement only. Attempts to repair the encoder can permanently damage it and void the warranty.

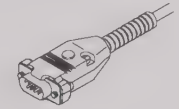
What to do

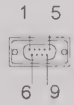
If an ACU-RITE linear encoder or readout is found to be at fault please contact your Authorized ACU-RITE Distributor for instructions prior to removing the encoders or readout.

Mechanical Specifications	Digital				Analog
Resolution (µm)	2	10	1	5	
Grating pitch (µm)	40		20		
Scale medium	Light transmission through chrome-coated glass				
Accuracy (@ 20° C) µm, ±, in any 1000mm	3, 5				
Max. slew speed (inches/sec)	40				
Force to move reading head (lbs)	≤ 0.75				
Operating Environment Temperature Relative Humidity	0° to 40°C 25% to 95% (non-condensing)				
Storage Environment Temperature Humidity	-40° to 65°C 20% to 95% (non-condensing)				
Weight w/armor cable (lbs)	1.4 + 0.05/in of measuring length				
Connecting cable armored or vinyl	Length = 5, 10, and 15 ft, Connector: DE-9P or Bendix PTO -GA-10-6P				
Max. cable length (ft)	35				
Measuring lengths (in)	2 - 120				
Reference pulse interval	Distance or coded				

Digital Differential

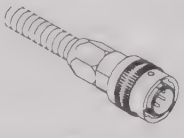
Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
N/C	Green	Yellow	Blue	Red	White	Brown	Pink	Gray
N/C	Channel A+	Channel A-	Channel B+	Channel B-	Ground	Vcc, + 5.1 ± 0.1 VDC @ 140mA max.	Channel R+	Channel R-

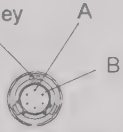




Analog Differential

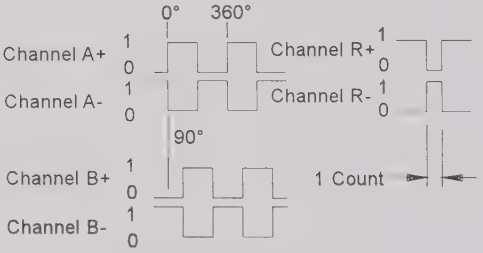
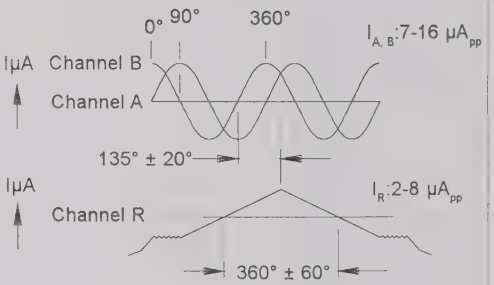
Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
White	Green	Yellow	Blue	Red	N/C	Brown	Pink	Gray
Ground	Channel A+	Channel A-	Channel B+	Channel B-	N/C	Vcc, + 5.0 ± 0.1 VDC @ 80mA max.	Channel R+	Channel R-





Digital single ended

Pin A	Pin B	Pin C	Pin D	Pin E	Pin F
Green	Blue	Brown	White	Drain	Pink
Channel A	Channel B	Vcc, +5 1 ± 0 1 VDC @ 140mA max.	Common (power supply and signal return)	Shield, reading head casting ground	Channel R (Reference Mark)

Parameter	Digital	Analog
Output Signals	I_{OH}=(High level output current) = 20mA V_{OH}=(High level output voltage) >2.5Vdc  I_{OL}=(Low level output current) = 20mA V_{OL}=(Low level output voltage) < 0.5Vdc	
Incremental signals	Square-wave voltage signals. Channels A and B, in 90° quadrature relationship	Similar phasing, but differential sinusoidal current output
Signal levels	TTL-level	7-16µA$_{pp}$ w/1 K Ohm load
Reference Mark signals	Square-wave pulse	Differential current output
Signal level	TTL-level	2-8µA$_{pp}$ w/100 K Ohm load
Power Supply	5.1 ± 0.1 VDC @ 100 mA max.	5.1 ± 0.1 VDC @ 70 mA max.

ACU-RITE products and accessories are warranted against defects in material and workmanship for a period of three years from the date of purchase. ACU-RITE will, at its option and expense, repair or replace any part of the ACU-RITE product which fails to meet this warranty. This warranty covers both materials and factory labor. In addition, authorized ACU-RITE distributors will provide field service labor for a period of one-year at no charge. Notice of the claimed defect must be received by ACU-RITE within the warranty period.

This warranty applies only to products and accessories installed and operated in accordance with this reference manual. ACU-RITE shall have no obligation, with respect to any defect or other condition caused in whole or in part by the customer's incorrect use, improper maintenance, modification of the equipment, or by the repair or maintenance of the product by any person except those deemed qualified by ACU-RITE.

Responsibility for loss of operation or diminished performance due to conditions beyond ACU-RITE's control cannot be accepted by ACU-RITE.

The foregoing warranty obligations are in lieu of all expressed or implied warranties. ACU-RITE INCORPORATED shall not be liable under any circumstances for consequential damages.

30 Day Red Carpet Warranty

All ACU-RITE products are covered by a 30-day Red Carpet Warranty. If in the first 30 days this product fails for any reason, repackage it in the original packaging materials and contact your Authorized ACU-RITE Distributor for return procedures.

Notes

www.manualsplus.com

1005288

ACU-RITE IS AN
ISO 9001
CERTIFIED
MANUFACTURER

CE

ACU-RITE®

ACU-RITE INCORPORATED
One Precision Way • Jamestown, NY 14701

101000-170 EDITION H 12/99